BALING BAG FOR AUTOMATIC BAG LOADING

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is related generally to bag loading and, more particularly, to a baling bag for use in automatic bag loading.

Description of the Related Art

Automated processes for package loading are desirable since it decreases labor costs and increases production efficiency. For example, there are known techniques for automatically loading cartons of fruit, such as apples. As noted above, automatic loading of cartons of fruit reduces labor costs and thus the cost of the finished product. In addition, production efficiency is greatly increased by such automated processing.

Despite the desirability of automated processing, not all processes have been automated. In one example, prepackaged bags of products, such as potatoes, are placed in a large shipping bag called a bale. In one example, a bale contains five individual 10 lb. bags of potatoes. Previous attempts to automate the bale loading process have been unsuccessful. Therefore, it can be appreciated that there is a significant need for a baling bag for use in an automatic process for loading bales. The present invention provides this and other advantages as will be apparent from the following detailed description and accompanying figures.

BRIEF SUMMARY OF THE INVENTION

The present invention is embodied in a bale bag and method for manufacturing the same. The bag has elongated front and back panels and adjoining elongated left and right side panels. The bag has a closed bottom

panel joining the front and back panels with the left and right panels and an open top portion. An aperture is provided proximate the top portion.

In an exemplary embodiment, the aperture is located in the back panel of the bag and in a further exemplary embodiment may be located substantially midway between the left and right side panels.

The aperture may be substantially circular in shape. Additional ventilation openings may be provided in the front and back panels if the baling bag is used with produce. A cutaway portion in the front panel proximate the top portion may be provided to expose the aperture.

The bag may be sized in accordance with industry standards and, in an exemplary embodiment has a length of approximately 32 inches for the left and right side panels and front and back panels. The front and back panels may have a width of approximately 13 inches and the left and right panels may have a width of approximately 7 inches.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Figure 1 is a top plan view of the inventive apparatus.

Figure 2 is a side view illustrating details of the inventive apparatus.

Figure 3 is a perspective view of a bale bag used with the inventive apparatus.

Figure 4 illustrates the bag of Figure 3 in an open configuration.

Figure 5 is a partial enlarged front elevation view of the bag of Figure 3.

Figure 6 is a top plan view illustrating the manufacture of the bag of Figure 3.

Figure 7 is a side view of the inventive apparatus.

Figure 8 is a top plan view illustrating the apparatus in operation.

Figure 9 is a top plan view illustrating the extraction of a bale bag.

Figure 10 is a top plan view illustrating linear displacement of the extracted bag.

Figure 11 is a top plan view illustrating the engagement of the extracted bag to open the bag.

Figure 12 is a top plan view illustrating the activation of the apparatus to open the extracted bag.

Figure 13 is a top plan view of the inventive apparatus illustrating linear displacement of the extracted opened bag into a loading area.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to a technique that automatically extracts a bag, such as a bale bag, opens the bag, and positions the bag for loading. The present invention is embodied in a system 100 illustrated in the top plan view of Figure 1. As illustrated in Figure 1, a plurality of bags 102 are placed on a protruding member 104. In one embodiment, the protruding member 104 is a rod mounted at an upwardly projecting angle, as illustrated in Figure 2, to permit gravity feeding of the bags 102.

Figure 2 is a side elevational view of the protruding member 104 illustrating its attachment to a frame 106 by a mounting bracket 108. The mounting bracket 108 may be attached to the frame 106 using screws, nuts and bolts, rivets, or other known mechanical attachment components. Those skilled in the art will recognize that the protruding member 104 may be directly mounted to the frame 106 using well-known conventional techniques, such as welding, adhesives, or the like. The protruding member 104 may have a rounded terminal portion 104t to minimize the potential to

damage to the aperture 124 when loading the bags 102 onto the protruding member. The rounded terminal portion 104t also makes it easier to place the bags 102 on the protruding member 104.

A cutting blade 110 is mounted at the lowest portion of the protruding member 104. The cutting blade 110 may be a razor blade, knife blade, or other known device. In one embodiment, the cutting blade 110 may be mounted in a slot (not shown) in the protruding member 104. The cutting blade 110 may be retained within the slot using conventional means, such as a set-screw, adhesive, or the like. As will be described in greater detail below, the cutting blade 110 is used to extract a bag 102 from the protruding member 104.

In one embodiment, the protruding member 104 is formed from a circular rod. The bag 102 is similar to a conventional bale bag, but is modified for use with the automatic system of the present invention. The bag 102 may be formed from one or more layers of brown paper. The bag 102 is illustrated in a folded or closed configuration in Figure 3. The bags 102 are folded in the manner of a conventional grocery bag to permit ease in shipping and storage. The bag 102 is shown in an unfolded or open configuration in Figure 4. Figure 4 also includes an enlarged portion illustrating the multi-layer arrangement of the bag 102. In the folded configuration, the dimensions of the bag 102 are approximately 13 inches wide by 32 inches long. When in the unfolded configuration, shown in Figure 4, the bag has a depth of approximately 7 inches and an opening of approximately 7 inches by 13 inches. Although the bag 102 may have the standard dimensions described above, those skilled in the art will recognize that the system 100 can be used with bags of virtually any dimension. The only accommodation for bags of different size may be the relative location of the various components of the system 100.

The bag 102 may be manufactured from a single large piece of paper, illustrated in Figure 5, that is cut, folded into several panels or portions, and glued in a conventional manner. The bag 102 has left and right side portions 112l and 112r, respectively. The bag 102 also includes front and back portions 114f and 114b, respectively. A strip 120 projects from the right side portion 112r. The strip 120 is glued to the back portion 114b when the bag 102 is formed. The left and right side portions 112l and 112r have flaps 121, which are used to seal the bottom of the bag 102. Similarly, the front and back portions 114f and 114b have flaps 123 that are also used to seal and form a bottom portion 116, as illustrated in Figure 3.

Once the bag 102 has been cut from stock material, it may be folded along fold lines 125 to form the front and back portions 114f and 114b and left and right side portions 112l and 112r. The strip 120 may be glued to the back portion 114b to seal the various portions. The bag also includes fold lines 127. The flaps 121 and 123 are folded at the fold lines 127 to form the bottom portion 116. The flaps 121 from the left and right side portions 112l and 112r are folded. The flap 123 from the front portion 114f is folded and glued to the flaps 121. Finally, the flap 123 from the back portion 114b is folded and glued to the flap 123 from the front portion 114f to seal the bottom portion 116 of the bag 102. In this manner, the bag 102 may be manufactured.

The bag 102 may be formed with creases to assist in folding the bag following manufacture. As illustrated in Figure 4, the bag 102 may include a front crease 122f on the front portion 114f extending from the left side portion 112l to the right side portion 112r near the bottom 116 of the bag. The precise location of the crease 122f is typically dependent on the dimensions of the bag. For example, the crease 122f may be located at a distance from the bottom portion 116 that is approximately one-half of the distance between the front portion 114f and the back portion 114b when the

bag is in the open configuration. In addition, the bag 102 may include creases 122l and 122r on the left and right side portions 112l and 112r, respectively. The crease 122l and 122r are located approximately midway between the front portion 114f and the back 114b when the bag is in the open configuration. The creases 122l and 122r extend from the top portion 118 to a point near the bottom portion 116. The creases 122l and 122r extend to a point approximately equal to the location of the crease 122f to facilitate folding of the bag 102. From the terminating point of the creases 122l and 122r, additional creases extend from the midline of the side portions 112l and 112r to the junctions of the side portions 112l and 112r with the front and back portions 114f and 114b near the bottom portion 116 of the bag 102.

The bag 102 also includes an aperture 124 in the top portion 118 of the back portion 114b. In an exemplary embodiment, the aperture 124 is approximately 0.625 inches in diameter and is located a short distance from the top of the back portion 114b. For example, the aperture 124 may be spaced apart from the top of the back portion 114b by approximately 0.25 inches. The short separation between the aperture 124 and the top of the back portion 114b of the bag 102 permits the easy extraction of the bag from the protruding member 104. In one embodiment, the bag 102 may be removed from the protruding 104 simply by tearing the back portion 114b at the point of narrow separation between the back portion and the aperture 124. The cutting blade 110 (see Figure 2) may be used to slice the back portion 114b at the aperture 124 thus preventing an undesirable tear. Alternatively, the bag 102 may include a perforated portion above the aperture to control the tearing. In this embodiment, the cutting blade 110 can be eliminated.

In the embodiment illustrated in Figures 3-5, the aperture 124 is circular in shape to match the cylindrical shape of the protruding member

104. The cylindrical shape of the protruding member 104 and the circular aperture 124 permit easy loading of bags 102 onto the protruding aperture. In addition, the bags 102 slide easily down the cylindrical protruding member 104.

Those skilled in the art will appreciate that the protruding member 104 may have different shapes and that the aperture 124 may be circular or may have a shape that corresponds to the selected shape for the protruding member. For example, the protruding member 104 may have a semi-circular shape with a rounded portion on top and a flat portion on the bottom. The bags 102 may still have the circular aperture 124, as illustrated in Figures 3-5, or may have a shape selected to correspond to the shape of the protruding member 104. Other shapes, such as triangular, rectangular, or the like may also be used satisfactorily with the system 100. The present invention is not limited by the specific geometric form of the protruding member 104 or the aperture 124.

Figure 5 is a fragmentary front elevational view of the bag 102 illustrating the location of the aperture 124 in the back portion 114b of the bag. A curve cutout 126 in the front portion 114f of the bag 102 more fully exposes the aperture 124 in the back portion 114b and allows easy insertion of the protruding member 104 through the aperture when loading the bags. The bag 102 may also have a series of ventilation holes 129 in the front and back portions 114f and 114b to allow ventilation of the packaged produce.

Returning again to Figure 1, the system 100 also includes a set vacuum-operated suction devices 130a and 130b to engage and extract a first bag 102 from the protruding member 104. The bags 102 are extracted from the protruding member 104 in the same sequence in which they are placed on the protruding member (*i.e.*, first on-first off). As illustrated in Figure 1, the vacuum-operated devices 130a-b have a terminal vacuum-operated suction cup 134a and 134b, respectively. As the vacuum-operated

devices 130a-b make contact with the bag 102, the bag is retained by virtue of the vacuum-operated suction cups 134a-b. The vacuum-operated devices 130a-b are mounted on air cylinder slides 136a and 136b, respectively. The air cylinder slides 136b move in a direction indicated by a reference arrow 132 to allow the suction cups 134a-b to engage a first of the bags 102 on the protruding member 104. The vacuum operated devices 130a-b may be positioned to engage the bag 102 at any desirable position. In an exemplary embodiment, the suction cups 134a-b engage a first side of the bag 102 on the back portion 114b (see Figure 4) near the top portion 118 at a distance of approximately 1.5-2 inches in from the left and right sides 112l and 112r, respectively.

The vacuum-operated devices 130a-b generate sufficient vacuum to engage a bag on the protruding member 104, extract the bag and support the weight of the bag. The precise vacuum level is not critical, but must be sufficiently strong to perform the tasks outlined above. A vacuum may be readily generated using Venturi devices in which air is passed over the open end of a tube in order to create a suction at a distal end of the tube. In the system 100, the vacuum-operated devices 130a-b are commercial products available from Vaccon Vacuum Generator.

In the embodiment illustrated in Figure 1, a pair of vacuum-operated devices 130a-b are used to support the bag 102. The use of dual vacuum-operated devices provides greater stability and relatively uniform extraction pressure on the bag 102 on both sides of protruding member 104 such that the bag is drawn smoothly against the cutting blade 110. Additional vacuum-operated devices may be used to provide additional stability or if the size of the bag 102 warrants extra support. However, if the bag 102 is relatively small, a single vacuum-operated device may be sufficient to extract the bag from the protruding member 104. Thus, the system 100 is not limited by the number or specific layout of the vacuum-

operated devices used to extract the bag 102 from the protruding member 104.

In operation, the air cylinder slides 136a-b and the vacuum-operated devices 130a-b move in the direction indicated by the reference arrow 132 to engage the bag 102 on the protruding member 104. Upon contact with the bag 102, the suction cups 134a-b engage a first side of the bag (*i.e.*, the back portion 114b) and retain the bag. As the air cylinder slides 136a-b and the vacuum-operated devices 130a-b move away from the protruding member 104 in the direction indicated by the reference arrow 132, a single bag 102 is extracted from the protruding member and held in position by virtue of the suction cups 134a-b. Thus, the system 100 is capable of automatically extracting a single bag 102 from the protruding member 104. As the vacuum-operated device 130 moves away from the protruding member in the direction indicated by the reference arrow 132, the cutting blade 110 slices through a portion of the bag 102 to allow its easy removal from the protruding member.

The use of air cylinder slides, such as the air cylinder slides 136a-b is well known in the art and need not be described in greater detail herein. Alternatively, the vacuum devices 130a-b may be moved back and forth in the direction indicated by the reference arrow 132 through other known techniques, such as stepper motors, servo motors, drive chains, belts, or the like. The system 100 is not limited by the specific technique used to move the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 132.

In addition to movement in the direction indicated by the reference arrow 132, the vacuum-operated devices 130a-b are capable of moving in the direction indicated by a reference arrow 138. To permit this movement, the vacuum-operated devices 130a-b are coupled to respective support brackets 140a and 140b. In turn, the support brackets 140a-b are

slidably coupled to a support member 142. Movement of the support brackets 140a-b and thus the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 138 is controlled by a stepper motor (not shown). In an exemplary embodiment, the vacuum-operated devices 130a and 130b move in unison in the direction indicated by the reference arrow 138. The vacuum-operated devices 130a-b may be locked together and controlled by a single stepper motor. Alternatively, the vacuum-operated devices 130a and 130b may be independent with the position of each of the vacuum-operated devices being controlled by individual stepper motors.

The positioning of the vacuum-operated devices 130a-b can be precisely controlled with stepper motors. Signals to control the operation of the stepper motors are generated by a conventional computer (not shown), such as a personal computer (PC), a single board microcomputer, microcontroller, or the like. Displacement of the vacuum-operated devices 130a-b is precisely controlled by the number of pulses provided to the stepper motor. Alternatively, the stepper motor may be replaced by other conventional drive means, such as air cylinder slides, servo motors, chain drives, belt drives, screw drives, and the like. Drive mechanisms, such as chain drives, may use position sensing microswitches (not shown) to control movement of the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 138. Use of such position sensing devices are well known in the art and need not be described in greater detail herein.

The system 100 has a second pair of vacuum-operated devices 150a and 150b that are positioned in opposition to the vacuum-operated devices 130a-b. A suction cup 154a and 154b is mounted at the terminal end of the vacuum-operated devices 150a-b, respectively. As will be described in detail below, the vacuum-operated devices 150a-b engage a bag 102 that has been previously been extracted by the vacuum-operated

devices 130a-b. As previously described, the vacuum-operated devices 130a-b move in the direction indicated by the reference 132 until the suction cups 134a-b engage a single bag 102 on a first side of the bag (*i.e.*, the back portion 114b). The vacuum may be activated as the air cylinder slides 136a-b are activated such that a vacuum is established before the suctions cups 134a-b make contact with the bag 102. Alternatively, the vacuum can be established as the suction cups 134a-b approach the bag 102. The vacuum is activated such that the suction cups 134a-b engage the first side of the bag 102. As the vacuum-operated devices 130a-b move away from the bags 102 in the direction indicated by the reference arrow 132, a single bag is extracted from the protruding member 104.

Following extraction of a single bag, the vacuum-operated devices 130a-b move in a direction indicated by the reference arrow 138 until the vacuum-operated devices are substantially aligned with the vacuum-operated devices 150a-b. The vacuum-operated devices 130a-b move in the direction indicated by the reference arrow 132 toward the vacuum-operated devices 150a-b until the suction cups 154a-b engage the second side of the bag 102 (*i.e.*, the front portion 114f) opposite the vacuum-operated devices 130a-b. The vacuum-operated devices 150a-b are positioned to engage the front portion 114f of the bag 102 on the opposite side of the bag from the vacuum-operated devices 130a-b.

When the suction cups 154a-b have engaged the second side of the back of the extracted bag 102, the vacuum may be activated and the vacuum-operated devices 130a-b moved in a direction indicated by the reference arrow 132 away from the vacuum-operated devices 150a-b to thereby unfold the bag. Alternatively, the vacuum for the vacuum-operated devices 150a-b may be activated as the extracted bag 102 approaches. The precise moment of activation of the vacuum-operated devices 150a-b is not critical to satisfactory operation of the system 100.

It should be noted that the vacuum-operated devices 150a-b are not mounted on air cylinder slides, such as the air cylinder slides 136a-b used to move the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 132. The construction and operation of the system 100 are simplified by fixing the position of the vacuum-operated devices 150a-b so that no movement occurs in the direction indicated by the reference arrow 132. Such an arrangement simplifies the system 100 by eliminating need for air cylinder slides and the associated measurement and control circuitry. However, if the system 100 is installed in a location that limits the movement of the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 132, it is possible to mount the vacuum-operated devices 150a-b on air cylinder slides to permit movement in the direction indicated by the reference arrow 132. In this embodiment, both sets of vacuum-operated devices (*i.e.*, the vacuum-operated devices 130a-b and 150a-b) are positioned on air cylinder slides (*e.g.*, the air cylinder slides 136a-b).

The vacuum-operated devices 150a-b are also capable of movement in a second direction indicated by the reference arrow 158. The vacuum-operated devices 150a-b are coupled to support brackets 160a and 160b. The support brackets 160a-b are slidably connected to a support member 162 to permit movement in the direction indicated by the reference arrow 158. Movement of the vacuum-operated devices 150a-b in the direction indicated by the reference arrow 158 is controlled by stepper motors. As discussed above with respect to the vacuum-operated devices 130a-b, a single stepper motor may be sufficient to move both vacuum-operated devices 150a-b. In this embodiment, the vacuum-operated devices 150a-b are coupled together for movement controlled by the single stepper motor. Alternatively, a stepper motor may be associated with each of the vacuum-operated devices 150a and 150b. Alternatively, the

movement of the vacuum-operated devices 150a-b in the direction indicated by the reference arrow 158 may be controlled by other conventional techniques, such as servo motors, air cylinder slides, chain drive, belt drive, screw drive, and the like. The present invention is not limited by the specific form of the drive mechanism used to control movement of the vacuum-operated devices 150a-b in the direction indicated by the reference arrow 158.

Following engagement of the front and back portions 114f and 114b of the bag 102, the vacuum-operated devices 130a-b and the vacuum-operated devices 150a-b move in synchronization in the direction indicated by the reference arrows 138 and 158, respectively. In this manner, the extracted and opened bag 102 is moved into position at a conveyor belt 170 where the bag may be loaded. Conventional devices are used to automatically load the opened bag 102. A set of clamps (not shown) attached to the top of the side portions 122l and 122r stabilize and retain the bag 102 while it is being loaded. As the product (*e.g.*, individual bags of potatoes) are loaded into the opened bag 102, the bottom 116 of the bag rests on the conveyor belt 170. After the products have been loaded into the bag 102, the side clamps (not shown) release and the conveyer belt 170 is activated to move the loaded bag 102 out of the loading area.

It should be noted that the sequence of opening the bag and moving the bag to the conveyor belt 170 may be performed interchangeably. That is, the extracted bag 102 may be unfolded and subsequently moved to the conveyor belt 170, as described above. Alternatively, the extracted bag 102 may be moved to the conveyor belt 170 while still in the folded configuration (see Figure 3). The bag 102 may be subsequently opened into the unfolded configuration (see Figure 4) after arrival at the conveyor belt 170. Thus, the present invention is not limited by the specific sequence of these two events.

Figure 7 is a side view of the system 100. As best seen in Figure 7, the vacuum-operated devices 130a-b and 150a-b are mounted at approximately the same height, but facing towards each other. As previously discussed, the vacuum-operated devices 130a-b and 150a-b are coupled to support members 142 and 162, respectively, by respective support brackets 140 and 160. In the exemplary embodiment illustrated in Figure 7, the support members 142 and 162 are rectangular supports that may conveniently be manufactured from aluminum or other conventional materials. As can be seen from Figure 7, the support members 142 and 162 each contain a channel 174. The mounting bracket 140 is inserted in the channel 174 of the support member 142 such that the vacuum-operated devices 130a-b may move smoothly along the channel in a direction indicated by the reference arrow 138 (see Figure 1). Similarly, the support bracket 160 is inserted into the channel 174 of the support member 162 to permit the vacuum-operated devices 150a-b to move easily along the channel in the direction indicated by the reference arrow 158 (see Figure 1).

Figures 7-12 are top plan views of the system 100 illustrating the positioning of the vacuum-operated devices 130a-b and 150a-b at different stages of the process. In Figure 8, the vacuum-operated devices 130a-b advance in the direction indicated by the reference arrow 132 until the suction cups 134a-b make contact with the first bag 102 on the protruding member 104. It should be noted that the vacuum device may be continuously activated at this step or may be activated at any point before contacting the bag 102 or at the time of contact of the bag. When the vacuum is activated, the suction cups 134a-b engage and retain the first bag 102 on the protruding member 104.

In Figure 9, the vacuum-operated devices 130a-b move in the direction indicated by the reference arrow 132 away from the protruding member 104. Because the first bag 102 is held in engagement with the

suction cups 134a-b by virtue of the vacuum, the first bag is extracted from the protruding member 104. As noted above, the small section of the bag 102 above the aperture 124 (see Figure 5) is torn by the process of removal from the protruding member 104. The cutting blade 110 (see Figure 2) may be used to control the extraction process by initiating the cut in the paper just above the aperture 124. In yet another alternative embodiment, the section of the bag 102 just above the aperture 124 may be perforated to control the tearing process as the first bag is extracted from the protruding member 104.

Figure 9 illustrates the position of the vacuum-operated devices 130a-b following the extraction of the first bag 102 from the protruding member 104. At this point, the extracted bag 102 is still in the folded configuration (see Figure 3). In Figure 10, the vacuum-operated devices 130a-b are displaced in the direction indicated by the reference arrow 138 until the vacuum-operated devices are substantially aligned with the vacuum-operated devices 150a-b.

In Figure 11, the air cylinder slides 136a and 136b are activated to move the vacuum-operated devices 130a-b in the direction indicated by the reference arrow 132 until the suction cups 154a-b make contact with the second side of the extracted bag 102. It should be noted that the vacuum-operated devices 130a-b are still activated such that the first side (*i.e.*, the back portion 114b) of extracted bag 102 is held in position by the suction cups 134a-b. When the vacuum-operated devices 150a-b are activated, the suction cups 154a-b engage and retain the second side (*i.e.*, the front portion 114f) of the extracted bag 102. As noted above with respect to the vacuum-operated devices 130a-b, the vacuum-operated devices 150a-b may be activated as the vacuum-operated devices 130a-b approach with the extracted bag 102 or after the suction cups 154a-b make contact with the second side (*i.e.*, the front portion 114f) of the extracted bag.

In Figure 12, the air cylinder slides 136a-b withdraw away from the vacuum-operated devices 150a-b in the direction indicated by the reference arrow 32. As the vacuum-operated devices 130a-b move away from the vacuum-operated devices 150a-b, the extracted bag 102 is opened into the unfolded configuration (see Figure 4). The bag 102 may be opened by moving one or both of the vacuum-operated devices 130a-b and 150a-b away from each other. In an exemplary embodiment, the vacuum-operated devices 150a-b are held in a constant position while only the vacuum-operated devices 130a-b move in the direction indicated by the reference arrow 132 away from the vacuum-operated devices 150a-b. This process places the extracted bag 102 in the unfolded configuration.

Alternatively, the vacuum-operated devices 150a-b also move in the direction indicated by a reference arrow 152 away from the vacuum-operated devices 130a-b. If both vacuum-operated devices 130a-b and 150a-b move approximately the same distance, the extracted bag 102 is placed in the unfolded configuration (see Figure 4) approximately centered between the support members 142 and 162. In yet another alternative, the vacuum-operated devices 130a-b may be held in a constant position while the vacuum-operated devices 150a-b move in a direction indicated by the reference arrow 152 away from the vacuum-operated device 130. In any of these combinations of movement, the extracted bag 102 is placed in the unfolded configuration.

The extracted and unfolded bag 102 is moved into position atop the conveyor belt 170, as shown in Figure 13. This movement is accomplished by synchronized movement of the vacuum-operated devices 130a-b and the vacuum-operated devices 150a-b. Specifically, the vacuum-operated devices 130a-b move in a direction indicated by the reference arrow 138 toward the conveyor belt 170 at a predetermined rate of movement. At the same time, the vacuum-operated devices 150a-b move in

a direction indicated by the reference arrow 158 toward the conveyor belt 170 at the same predetermined rate thus maintaining the position of the suction cups 134a-b and 154a-b with respect to the extracted and unfolded bag 102. While at the conveyor belt 170, the unfolded bag 102 is filled in a conventional manner. As previously discussed, a clamping mechanism (not shown) clamps the open bag in position on the conveyor belt 170 to permit loading. The open bag 102 is automatically loaded with prepackaged bags of produce using a conventional automatic loading machine (not shown).

One the clamps (not shown) have been activated to secure the open bag 102, the process of extracting a new bag may be repeated. That is, the vacuum is deactivated so that the vacuum-operated devices 130a-b and 150a-b no longer support the open bag 102. The vacuum-operated devices 150a-b return to their original starting position. The air cylinder slides 136a-b retract and the vacuum-operated devices 130a-b are returned to their original position. The entire process is repeated to automatically extract the next bag 102 from the protruding member 104.

Thus, the system 100 automatically extracts a single bag from the protruding member 104, opens the extracted bag to an unfolded configuration, and moves the extracted open bag into position on the conveyor belt 170. As previously noted, it is possible to move the extracted bag 102 into position above the conveyor belt 170 before opening the bag. That is, the process of opening the extracted bag 102 into the unfolded configuration (see Figure 4) may be performed in the sequence illustrated in Figures 11 and 12 or the process may be reversed such that the unopened extracted bag 102 is first moved to the conveyor belt 170 and opened into the unfolded configuration. In either event, the process of extracting bags is automated by the system 100 thus reducing labor costs and increase efficiency. In an exemplary embodiment, the protruding member 104 is sufficiently long to hold a large number (*e.g.*, 50) of bags 102.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the invention. Therefore, the present invention is to be limited only by the appended claims.